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Baishideng Publishing Group Inc
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ORIGINAL ARTICLE

Retrospective Study

Associations among pain catastrophizing, muscle strength, and physical performance after total knee and hip arthroplasty

Kazuhiro Hayashi, Masato Kako, Kentaro Suzuki, Keiko Hattori, Saori Fukuyasu, Koji Sato, Izumi Kadono, Tadahiro Sakai, Yukiharu Hasegawa, Yoshihiro Nishida

Kazuhiro Hayashi, Masato Kako, Kentaro Suzuki, Keiko Hattori, Saori Fukuyasu, Koji Sato, Izumi Kadono, Yoshihiro Nishida, Department of Rehabilitation, Nagoya University Hospital, Aichi 466-8550, Japan

Izumi Kadono, Tadahiro Sakai, Yukiharu Hasegawa, Yoshihiro Nishida, Department of Orthopaedic Surgery, Nagoya University Graduate School and School of Medicine, Aichi 466-8560, Japan

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Correspondence to: Kazuhiro Hayashi, PT, MSc, Department of Rehabilitation, Nagoya University Hospital, 65 Tsuruma-cho, Showa-ku, Nagoya, Aichi 466-8550, Japan. hayashi.k@med.nagoya-u.ac.jp
Telephone: +81-52-7442687
Fax: +81-52-7442686

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Abstract

AIM

To investigate whether reductions in pain catastrophizing associated with physical performance in the early period after total knee arthroplasty (TKA) or total hip arthroplasty (THA).

METHODS

The study group of 46 participants underwent TKA or THA. The participants were evaluated within 7 d before the operation and at 14 d afterwards. Physical performance was measured by the Timed Up and Go (TUG) test, and 10-m gait time was measured at comfortable and maximum speeds. They rated their knee or hip pain using a visual analog scale (VAS) for daily life activities. Psychological characteristics were measured by the Pain Catastrophizing Scale (PCS). Physical characteristics were measured by isometric muscle strength of knee extensors and hip abductors on the operated side. The variables of percent changes between pre- and post-operation were calculated by dividing post-operation score by pre-operation score.

RESULTS

Postoperative VAS and PCS were better than pre-operative for both TKA and THA. Postoperative physical performance and muscle strength were poorer than

preoperative for both TKA and THA. The percent change in physical performance showed no correlation with preoperative variables. In TKA patients, the percent change of PCS showed correlation with percent change of TUG (P = 0.016), 10-m gait time at comfortable speeds (P = 0.003), and 10-m gait time at maximum speeds (P = 0.042). The percent change of muscle strength showed partial correlation with physical performances. The percent change of VAS showed no correlation with physical performances. On the other hand, in THA patients, the percent change of hip abductor strength showed correlation with percent change of TUG (P = 0.047), 10-m gait time at comfortable speeds (P = 0.001), and 10-m gait time at maximum speeds (P = 0.021). The percent change of knee extensor strength showed partial correlation with physical performances. The percent change of VAS and PCS showed no correlation with physical performances.

CONCLUSION

Changes in pain catastrophizing significantly associated with changes in physical performance in the early period after TKA. It contributes to future postoperative rehabilitation of arthroplasty.

Key words: Gait; Hip arthroplasty; Knee arthroplasty; Osteoarthritis; Pain; Pain management; Postoperative care

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Core tip: This clinical trial investigated whether reductions in pain catastrophizing are associated with physical performance in the early period after total knee arthroplasty (TKA) or total hip arthroplasty (THA). We found that changes in pain catastrophizing were significantly associated with physical performance in the early period after TKA. These findings may contribute to future postoperative rehabilitation of the arthroplasties in lower limbs. Treatment based on cognitive-behavioral therapy might be useful in the early period, particularly after TKA.

Hayashi K, Kako M, Suzuki K, Hattori K, Fukuyasu S, Sato K, Kadono I, Sakai T, Hasegawa Y, Nishida Y. Associations among pain catastrophizing, muscle strength, and physical performance after total knee and hip arthroplasty. *World J Orthop* 2017; 8(4): 336-341 Available from: URL: http://www.wjgnet.com/2218-5836/full/v8/i4/336.htm DOI: http://dx.doi.org/10.5312/wjo.v8.i4.336

INTRODUCTION

Osteoarthritis leads to considerable morbidity in terms of pain, functional disability, lowered quality of life, and psychological problems[1]. Total knee arthroplasty (TKA) and total hip arthroplasty (THA) improve pain and physical performance in participants with end-stage arthritis[1]. The number of TKA and THA procedures performed is increasing worldwide[1]. Early postoperative recovery is important in particularly rehabilitation; however, uncertainty exists about effective rehabilitation methods for physical performance.

Pain treatment has targeted not only pain intensity, but also pain catastrophizing, which has been conceptualized as a negative cognitive-affective response to pain[2]. The patients with high pain catastrophizing suggest that cognitive-behavioral intervention should incorporate in treatment[2]. Recently systematic review concludes better outcome associates with grater reduction in pain catastrophizing during treatment in low back pain[3]. The review shows a mediating effect is found in all studies assessing the impact of a decrease in catastrophizing during treatment[3]. In addition, some studies have reported pain catastrophizing associated with physical performance than pain intensity, in low back pain[4,5]. On the other hand, the impact of reduction in pain catastrophizing on outcome has not investigated in patients with TKA or THA, although pain catastrophizing has investigated only at baseline[6-11]. In changes of pain related variables, the changes in postoperative pain intensity associate with changes in physical performance within 16 d after either TKA or THA[12]. It has not investigated whether pain intensity or pain catastrophizing have mediating effect of physical performance.

The purpose of the present study is to determine whether reductions in pain catastrophizing are associated with physical performance in the early period after TKA or THA.

MATERIALS AND METHODS

Participants

A total of 46 participants were enrolled. Twenty-three underwent initial TKA, and 23 underwent initial THA between September 2014 and April 2015 at Nagoya University Hospital (Table 1). Exclusion criteria were that the participant (1) was diagnosed with cognitive impairment; and (2) had pain in other body parts that was more severe than in the operative site. All participants underwent a baseline preoperative visit prior to their operation and received standardized in-participant treatment including usual rehabilitation, following either a primary total hip or total knee care pathway.

This cross sectional study was approved by the Ethics Committee of Nagoya University Hospital (No. 328). All the participants provided written informed consent.

Measures

Demographic data including age, sex, height, body weight, and body mass index were measured. The participants were evaluated within 7 d before the operation and at 14 d afterwards. Physical performance was measured

Table 1 Participant characteristics

	THA	TKA
Sex (male/female)	4/19	9/14
Age	61.17 ± 10.32	69.65 ± 8.52
Height (cm)	155.84 ± 8.34	153.01 ± 10.37
Body weight (kg)	58.66 ± 13.75	60.78 ± 12.87
Body mass index (kg/m^2)	24.05 ± 4.30	25.80 ± 4.25

Data for age, height, body weight, and body mass index are presented as mean ± SD. THA: Total hip arthroplasty; TKA: Total knee arthroplasty.

by the Timed Up and Go (TUG) test, and 10-m gait time was measured at comfortable and maximum speeds[13,14]. Participants were allowed to use a walking aid, based on walking ability. They rated their knee or hip pain using a visual analog scale (VAS) for daily life activities. Psychological characteristics were measured by the Pain Catastrophizing Scale (PCS)[15,16]. Physical characteristics were measured by isometric muscle strength of knee extensors and hip abductors on the operated side[17-22].

Physical performance: The 10-m gait test was used to measure the time it took the participant to walk 10 m at comfortable and maximum speeds. Timing at each of the two speeds was measured twice. Participants were timed using a stopwatch as they moved along a 10-m walkway. Participants stood directly behind the start line and were clocked from the moment the first foot crossed the start line until the lead foot crossed the finish line. Participants were instructed to continue at least 2 m past the finish line to eliminate the deceleration effects from stopping the gait. Gait speeds were then expressed as meters per second[13]. For the comfortable-gait speed trial, participants were instructed to walk at their normal comfortable speeds. For the maximum-speed trials, they were asked to walk as fast as they could safely do so without running. Each participant performed two valid trials, and the higher-speed trial was used for analysis.

The TUG test is a measure frequently used to assess function in older individuals[14]. Subjects were given verbal instructions to stand up from a chair, walk 3 m as quickly and as safely as possible, cross a line marked on the floor, turn around, walk back, and sit down. Each participant performed two valid trials, and the higher-speed trial was used for analysis.

Psychological measures: For the 13-item PCS, participants rate how frequently they have experienced various cognitions or emotions[15,16]. The PCS comprises three subscales: rumination (*e.g.,* "I keep thinking about how much it hurts"), magnification (*e.g.,* "I wonder whether something serious may happen"), and helplessness (*e.g.,* "There is nothing I can do to reduce the intensity of the pain")[15,16]. The total score range is 0-52[15,16]. Several findings support this scale's validity as a measure of PCS[15,16].

Isometric muscle strength: The isometric muscle strength of the hip abductors and knee extensors was measured using a hand-held gauge meter (μ-Tas F-100; Anima, Tokyo, Japan). The strength of the hip abductors was measured in the supine position with both lower limbs in neutral position. The transducer was placed at the lateral femoral condyles[17]. The strength-testing position of the knee extensors was confirmed using a goniometer at a hip angle of 90° and knee flexed to 60°. If necessary, the feet were supported by a small bench[18-22]. A strap was attached between the examination couch and a point on the participant's ankle, 5 cm above the lateral malleolus. The transducer was then placed at the front of the ankle under the strap to measure the extension strength. The participants were asked to push maximally against the force transducer for 5 s. Participants performed two contractions separated by a 60-s interval. The highest value was used for analysis. Muscle strength was expressed as the maximum voluntary torque with use of the external lever-arm length. The lever-arm length was the distance from the trochanter major to the center of the dynamometer for hip abductors and from the lateral femoral epicondyle to the center of the dynamometer for knee extensors.

Statistical analysis

All data are expressed as mean ± SD. The variables of percent changes between pre- and post-operation were quantified. It was calculated dividing post-operation score by pre-operation score[18]. Their resultant data were analyzed by paired *t*-test. The correlation of physical performance with psychological and physical variables was analyzed by the Pearson *r* rank test. The data were analyzed with SPSS software (version 20.0 for Microsoft Windows; SPSS, Chicago, IL, United States). A value of $P < 0.05$ was considered statistically significant.

RESULTS

Pre- and post-operative data are shown in Table 2. The mean ± SD of VAS in THA and TKA were at preoperative of 37.87 ± 24.20, and 41.91 ± 27.09, and postoperative at 14-d of 17.61 ± 20.29, and 25.22 ± 20.41. The mean ± SD of PCS in THA and TKA were at preoperative of 28.70 ± 9.28, and 28.26 ± 11.90, and postoperative at 14-d of 18.70 ± 11.19, and 20.26 ± 10.72. Postoperative VAS and PCS were better than preoperative for both TKA and THA. Postoperative physical performance and muscle strength were poorer than preoperative for both TKA and THA.

The correlations between physical performance and other variables are shown in Table 3. The percent change in physical performance showed no correlation with preoperative variables. In TKA patients, the percent change of PCS showed correlation with percent change of TUG ($P = 0.016$), 10-m gait time at comfortable speeds ($P = 0.003$), and 10-m gait time at maximum speeds ($P = 0.042$). The percent change of muscle strength showed

Table 2 Pre- and postoperative data according to site of replacement

	THA			TKA		
	Preoperative	Postoperative at 14-d	*P*-value	Preoperative	Postoperative at 14-d	*P*-value
TUG (s)	11.51 ± 3.82	13.67 ± 5.65	0.004[a]	12.22 ± 4.33	16.42 ± 9.09	0.004[a]
10 m gait speeds at comfortable (m/s)	0.97 ± 0.23	0.92 ± 0.20	0.187	0.99 ± 0.24	0.77 ± 0.23	0.000[a]
10 m gait speeds at maximum (m/s)	1.28 ± 0.34	1.11 ± 0.32	0.005[a]	1.19 ± 0.34	0.95 ± 0.32	0.000[a]
VAS	37.87 ± 24.20	17.61 ± 20.29	0.001[a]	41.91 ± 27.09	25.22 ± 20.41	0.004[a]
PCS	28.70 ± 9.28	18.70 ± 11.19	0.000[a]	28.26 ± 11.90	20.26 ± 10.72	0.003[a]
Muscle strength (kgf*m)						
Hip abductor strength (operated side)	2.62 ± 1.63	2.04 ± 1.36	0.026[a]	3.49 ± 2.06	2.10 ± 1.63	0.001[a]
Knee extensor strength (operated side)	4.78 ± 3.19	3.99 ± 1.59	0.240	4.46 ± 2.82	2.55 ± 2.13	0.001[a]

These data were analyzed with paired *t*-tests. Data for TUG, 10-m gait speeds, VAS, PCS, and muscle strength are presented as mean ± SD. [a]$P < 0.05$. THA: Total hip arthroplasty; TKA: Total knee arthroplasty; TUG: Timed Up and Go; VAS: Visual analog scale; PCS: Pain Catastrophizing Scale.

Table 3 Correlation between percent changes from pre- to post-operative physical performance and other variables

	THA				TKA		
	ΔTUG (s)	Δ10 m gait speeds at comfortable (m/s)	Δ10 m gait speeds at maximum (m/s)		ΔTUG (s)	Δ10 m gait speeds at comfortable (m/s)	Δ10 m gait speeds at maximum (m/s)
Preoperative				Preoperative			
VAS	r = 0.184	0.083	-0.025	VAS	r = 0.237	-0.177	-0.287
	P = 0.402	0.707	0.908		P = 0.276	0.419	0.184
PCS	r = 0.270	0.021	-0.119	PCS	r = -0.184	0.122	0.169
	P = 0.213	0.923	0.588		P = 0.400	0.579	0.442
Hip abductor strength (operated side, kg f)	r = 0.063	-0.165	-0.161	Hip abductor strength (operated side, kg f)	r = -0.168	0.142	0.084
	P = 0.774	0.452	0.464		P = 0.444	0.517	0.703
Knee extensor strength (operated side, kg f)	r = 0.044	-0.235	-0.278	Knee extensor strength (operated side, kg f)	r = -0.077	0.070	-0.102
	P = 0.842	0.281	0.199		P = 0.726	0.751	0.643
Percent changes				Percent changes			
ΔVAS	r = 0.225	-0.093	-0.212	ΔVAS	r = 0.085	-0.265	-0.129
	P = 0.302	0.672	0.332		P = 0.699	0.221	0.558
ΔPCS	r = 0.117	-0.042	-0.047	ΔPCS	r = 0.495	-0.583	-0.427
	P = 0.594	0.849	0.831		P = 0.016[a]	0.003[a]	0.042[a]
ΔHip abductor strength (operated side, kg f)	r = -0.418	0.642	0.479	ΔHip abductor strength (operated side, kg f)	r = -0.333	0.373	0.546
	P = 0.047[a]	0.001[a]	0.021[a]		P = 0.121	0.079	0.007[a]
ΔKnee extensor strength (operated side, kg f)	r = -0.247	0.434	0.530	ΔKnee extensor strength (operated side, kg f)	r = -0.389	0.474	0.656
	P = 0.257	0.038[a]	0.009[a]		P = 0.066	0.022[a]	0.001[a]

These data were analyzed by the Pearson r rank test, with the r value as the correlation coefficient; [a]$P < 0.05$. THA: Total hip arthroplasty; TKA: Total knee arthroplasty; TUG: Timed Up and Go; VAS: Visual analog scale; PCS: Pain catastrophizing scale.

partial correlation with percent change of physical performances. The percent change of VAS showed no correlation with percent change of physical performances. On the other hand, in THA patients, the percent change of hip abductor strength showed correlation with percent change of TUG (P = 0.047), 10-m gait time at comfortable speeds (P = 0.001), and 10-m gait time at maximum speeds (P = 0.021). The percent change of knee extensor strength showed partial correlation with percent change of physical performances. The percent change of VAS and PCS showed no correlation with percent change of physical performances.

DISCUSSION

The present study showed that changes in pain catastrophizing significantly associated with changes in physical performance in the early period after TKA, but not after THA. Changes in muscle strength significantly associated with changes in physical performance in the early period after TKA and THA. Quantification of early postoperative changes and their potential relationships to physical performance can reveal responsible mechanisms and contribute to future postoperative rehabilitation.

The importance of assessing pain catastrophizing has been highlighted in preoperative TKA or THA patients[6-11]. Pain catastrophizing associated with physical performance, more so than was pain intensity in low back pain[4,5]. In addition, better physical performance associated reduction in pain catastrophizing during treatment than scores at baseline in low back pain[3]. Some reports in low back pain showed pain catastrophizing at baseline was no

predictive for disability at follow-up[3]. This study, first, showed reductions in pain catastrophizing associated with physical performance in the early period after TKA. It is important in early postoperative treatment outcome, at least after TKA. For example, treatment that incorporates a cognitive-behavioral intervention can lead to reduction in pain catastrophizing concurrent with reduction in pain-related activity interference and disability among persons with persistent pain[2]. The intervention targeted a decrease in maladaptive behaviors, an increase in adaptive behaviors, identification, and correction of maladaptive thoughts and beliefs, and an increase in self-efficacy for pain management[23]. It was introduced to reduce pain and psychological distress and to improve physical and role function[23]. Medical staff should expand their evaluations beyond traditional demographics and medical status variables to include pain-related psychological constructs when addressing perioperative participants.

The present study showed that, in the early period after THA, changes in physical performances were not significantly associated with changes in pain catastrophizing. The VAS and PCS at postoperative at 14-d in THA was less than in TKA, consistent with previous study[24]. In general, pain-related disability might be resolved at an earlier stage than 14 d after THA. However, a recent systematic review concluded that there is no evidence for psychological factors as an influence on outcome after THA[8]. Further investigation is needed to assess longitudinal changes after THA.

Preoperative and postoperative muscle weakness is a major contributor to poor physical performance after TKA and THA[25-27]. The present study showed changes in physical performance were associated with changes in muscle strength.

There are several limitations in this study. We included only a small number of participants from a single medical center, so our observations must be interpreted with caution. The present study investigated only the early postoperative period; these findings should be considered preliminary for TKA and THA, although other studies have considered physical function in the early period after TKA and THA[12,18,24]. Scores on the preoperative PCS in the present study were higher than those reported in previous TKA studies[9-11]. This finding might be confined to the patients with high pain catastrophizing. A larger and long-term study to investigate further the association among changes in pain catastrophizing, muscle strength, and physical performance is required.

Changes in levels of pain catastrophizing were associated with changes in physical performance in the early period after TKA; and changes in muscle strength were associated with changes in physical performance in this period after both TKA and THA. These findings may contribute to future postoperative rehabilitation of lower-limb arthroplasties. Treatment based on cognitive-behavioral therapy might be useful in the early period, at least after TKA.

COMMENTS

Background

Pain treatment has targeted not only pain intensity, but also pain catastrophizing, which has been conceptualized as a negative cognitive-affective response to pain. The changes in postoperative pain intensity associate with changes in physical performance after total knee arthroplasty (TKA) or total hip arthroplasty (THA). On the other hand, the impact of changes in pain catastrophizing on outcome has not investigated in patients with TKA or THA.

Research frontiers

The purpose of the present study is to determine whether reductions in pain catastrophizing are associated with physical performance in the early period after TKA or THA.

Innovations and breakthroughs

This study, first, showed reductions in pain catastrophizing associated with physical performance in the early period after TKA.

Applications

The findings may contribute to future postoperative rehabilitation of lower-limb arthroplasties. Treatment based on cognitive-behavioral therapy might be useful in the early period, at least after TKA.

Peer-review

It is an interesting manuscript on investigating and comparing physical performance, pain ratings, pain catastrophizing, and muscle strength. This study is definitely worth publishing.

REFERENCES

1 **Healy WL**, Sharma S, Schwartz B, Iorio R. Athletic activity after total joint arthroplasty. *J Bone Joint Surg Am* 2008; **90**: 2245-2252 [PMID: 18829924 DOI: 10.2106/JBJS.H.00274]

2 **Quartana PJ**, Campbell CM, Edwards RR. Pain catastrophizing: a critical review. *Expert Rev Neurother* 2009; **9**: 745-758 [PMID: 19402782 DOI: 10.1586/ern.09.34]

3 **Wertli MM**, Burgstaller JM, Weiser S, Steurer J, Kofmehl R, Held U. Influence of catastrophizing on treatment outcome in patients with nonspecific low back pain: a systematic review. *Spine* (Phila Pa 1976) 2014; **39**: 263-273 [PMID: 24253796 DOI: 10.1097/BRS.0000000000000110]

4 **Swinkels-Meewisse IE**, Roelofs J, Oostendorp RA, Verbeek AL, Vlaeyen JW. Acute low back pain: pain-related fear and pain catastrophizing influence physical performance and perceived disability. *Pain* 2006; **120**: 36-43 [PMID: 16359797 DOI: 10.1016/j.pain.2005.10.005]

5 **Larivière C**, Bilodeau M, Forget R, Vadeboncoeur R, Mecheri H. Poor back muscle endurance is related to pain catastrophizing in patients with chronic low back pain. *Spine* (Phila Pa 1976) 2010; **35**: E1178-E1186 [PMID: 20881658 DOI: 10.1097/BRS.0b013e3181e53334]

6 **Burns LC**, Ritvo SE, Ferguson MK, Clarke H, Seltzer Z, Katz J. Pain catastrophizing as a risk factor for chronic pain after total knee arthroplasty: a systematic review. *J Pain Res* 2015; **8**: 21-32 [PMID: 25609995 DOI: 10.2147/JPR.S64730]

7 **Lewis GN**, Rice DA, McNair PJ, Kluger M. Predictors of persistent pain after total knee arthroplasty: a systematic review and meta-analysis. *Br J Anaesth* 2015; **114**: 551-561 [PMID: 25542191 DOI: 10.1093/bja/aeu441]

8 **Vissers MM**, Bussmann JB, Verhaar JA, Busschbach JJ, Bierma-Zeinstra SM, Reijman M. Psychological factors affecting the outcome of total hip and knee arthroplasty: a systematic review. *Semin Arthritis Rheum* 2012; **41**: 576-588 [PMID: 22035624 DOI: 10.1016/j.semarthrit.2011.07.003]

9 **Riddle DL**, Wade JB, Jiranek WA, Kong X. Preoperative pain catastrophizing predicts pain outcome after knee arthroplasty. *Clin*

Orthop Relat Res 2010; **468**: 798-806 [PMID: 19585177 DOI: 10.1007/s11999-009-0963-y]
10 **Forsythe ME**, Dunbar MJ, Hennigar AW, Sullivan MJ, Gross M. Prospective relation between catastrophizing and residual pain following knee arthroplasty: two-year follow-up. *Pain Res Manag* 2008; **13**: 335-341 [PMID: 18719716 DOI: 10.1155/2008/730951]
11 **Sullivan M**, Tanzer M, Reardon G, Amirault D, Dunbar M, Stanish W. The role of presurgical expectancies in predicting pain and function one year following total knee arthroplasty. *Pain* 2011; **152**: 2287-2293 [PMID: 21764515 DOI: 10.1016/j.pain.2011.06.014]
12 **Stratford PW**, Kennedy DM. Performance measures were necessary to obtain a complete picture of osteoarthritic patients. *J Clin Epidemiol* 2006; **59**: 160-167 [PMID: 16426951 DOI: 10.1016/j.jclinepi.2005.07.012]
13 **Watson MJ.** Refining the Ten-metre Walking Test for Use with Neurologically Impaired People. *Physiotherapy* 2002; **88**: 386-397 [DOI: 10.1016/S0031-9406(05)61264-3]
14 **Podsiadlo D**, Richardson S. The timed "Up & amp; Go": a test of basic functional mobility for frail elderly persons. *J Am Geriatr Soc* 1991; **39**: 142-148 [PMID: 1991946 DOI: 10.1111/j.1532-5415.1991.tb01616.x]
15 **Sullivan MJL**, Bishop SR, Pivik J. The Pain Catastrophizing Scale: development and validation. *Psychol Assess* 1995; **7**: 524-532 [DOI: 10.1037/1040-3590.7.4.524]
16 **Matsuoka H**, Sakano Y. Assessment of cognitive aspect of pain: development, reliability, and validation of Japanese version of Pain Catastrophizing Scale. *Jpn J Psychosom Med* 2007; **47**: 95-102
17 **Andrews AW**, Thomas MW, Bohannon RW. Normative values for isometric muscle force measurements obtained with hand-held dynamometers. *Phys Ther* 1996; **76**: 248-259 [PMID: 8602410]
18 **Holm B**, Kristensen MT, Husted H, Kehlet H, Bandholm T. Thigh and knee circumference, knee-extension strength, and functional performance after fast-track total hip arthroplasty. *PM R* 2011; **3**: 117-124; quiz 124 [PMID: 21333950 DOI: 10.1016/j.pmrj.2010.10.019]
19 **Winters JD**, Christiansen CL, Stevens-Lapsley JE. Preliminary investigation of rate of torque development deficits following total knee arthroplasty. *Knee* 2014; **21**: 382-386 [PMID: 24238649 DOI: 10.1016/j.knee.2013.10.003]
20 **Lienhard K**, Lauermann SP, Schneider D, Item-Glatthorn JF, Casartelli NC, Maffiuletti NA. Validity and reliability of isometric, isokinetic and isoinertial modalities for the assessment of quadriceps muscle strength in patients with total knee arthroplasty. *J Electromyogr Kinesiol* 2013; **23**: 1283-1288 [PMID: 24113423 DOI: 10.1016/j.jelekin.2013.09.004]
21 **Roy MA**, Doherty TJ. Reliability of hand-held dynamometry in assessment of knee extensor strength after hip fracture. *Am J Phys Med Rehabil* 2004; **83**: 813-818 [PMID: 15502733]
22 **Kwoh CK**, Petrick MA, Munin MC. Inter-rater reliability for function and strength measurements in the acute care hospital after elective hip and knee arthroplasty. *Arthritis Care Res* 1997; **10**: 128-134 [PMID: 9313401 DOI: 10.1002/art.1790100208]
23 **Buenaver LF**, Campbell CM, Haythornthwaite JA. Cognitive-Behavioral Therapy for Chronic Pain. In: Fishman SM, Ballantyne JC, Rathmell JP, editor. Bonica's Management of Pain, 4th ed. Philadelphia, PA: Lea and Febiger, 2009: 1220-1229
24 **Giaquinto S**, Ciotola E, Margutti F. Gait in the early days after total knee and hip arthroplasty: a comparison. *Disabil Rehabil* 2007; **29**: 731-736 [PMID: 17453995 DOI: 10.1080/09638280600926389]
25 **Mizner RL**, Petterson SC, Clements KE, Zeni JA, Irrgang JJ, Snyder-Mackler L. Measuring functional improvement after total knee arthroplasty requires both performance-based and patient-report assessments: a longitudinal analysis of outcomes. *J Arthroplasty* 2011; **26**: 728-737 [PMID: 20851566 DOI: 10.1016/j.arth.2010.06.004]
26 **Vaz MD**, Kramer JF, Rorabeck CH, Bourne RB. Isometric hip abductor strength following total hip replacement and its relationship to functional assessments. *J Orthop Sports Phys Ther* 1993; **18**: 526-531 [PMID: 8220410 DOI: 10.2519/jospt.1993.18.4.526]
27 **Bamaç B**, Çolak T, Özbek A, Çolak S, Cinel Y, Yenigün Ö. Isokinetic performance in elite volleyball and basketball players. *Kinesiology* 2008; **40**: 182-188

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